

from four to six in number, and as they have to sustain heavy shocks, owing to the occasional pressure of water in the cylinders, the stress in the bolts at the bottom of the thread is kept low, say from 3000 to 3500 lb. per square inch. Sometimes all these bolts are turned and fitted into reamer holes, but some makers fit only two turned bolts, those on opposite diagonal corners. The cylinder foot may have a thickness to $i j$ times the diameter of column-bolt.

The cylinder covers are of heavy ribbed- or box-section, special attention being given to the low-pressure cover to avoid light sections which may cause unsightly "breathing" as the steam is admitted into the cylinders. The shape of the covers follows that of the top side of the piston.

If a liner is fitted to the cylinder when hot, the under side of that part of the cover which projects into the cylinder is made just to clear the top of the liner, allowing, of course, for the thickness of jointing material, thus helping to keep the liner in position.

The thickness of metal in the cover may be about 0.6 to 0.8 times the thickness of the cylinder, the usual conical shape of the cover giving ample strength. The cover flange may have a thickness of $i j$ times the diameter of studs. The size of the studs is usually determined for the high-pressure cylinder cover and made the same for all the covers, including those for the valve chests, enabling the same spanner to be used throughout. Full boiler pressure is assumed acting upon the diameter of the stud circle, and a diameter of stud chosen such that their number will give a pitch of from 3 to 3.1 times the diameter of stud. Studs having a diameter less than 2 in. in the body should not be used, and the stress at the bottom of the thread should not be more than 4000 lb. per square inch for the smaller diameters, or more than 5500 lb. for the larger. The pitch of the studs in the intermediate-pressure and low-pressure cylinders may be from 4, to 5 diameters and 6 to 7 diameters respectively. The internal projection of the cover is well cut away opposite the steam port, to allow an easy flow for the steam. The larger cylinder covers often have an

inspection door
 or manhole in the centre of about 15 or 16-in. diameter, to
 permit access
 and inspection. This door is, of course, placed off the centre
 in the bottom
 covers. Bosses for relief valves are provided, the valves
 having a diameter
 of $\frac{1}{4}$ to $\frac{1}{2}$ the diameter of the cylinder. There are also
 bosses for drain
 and indicator cocks.

When designing the cylinders, provision for attaching the
 lagging sheets
 should not be forgotten.

The clearance between the piston and the covers is $\frac{1}{8}$ to $\frac{1}{4}$ in. at the top and $\frac{1}{4}$ to $\frac{1}{2}$ in. at the bottom for cylinders of 16 to 24 in. diameter, $\frac{1}{8}$ to $\frac{1}{4}$ in. at the top and $\frac{1}{4}$ to $\frac{1}{2}$ in. at the bottom for cylinders of 40 to 60 in. diameter, and $\frac{1}{4}$ to $\frac{1}{2}$ in. at the top and $\frac{1}{2}$ to $\frac{3}{4}$ in. at the bottom for cylinders of 80 to 100 in. diameter.

The steam ports have one or more internal
 strengthening ribs connect-
 ing the top flange with the body of the cylinder.

Valves.—The usual practice for triple-expansion
 engines is to equip